REMARKS

Entry of the foregoing and reconsideration of the subject application are respectfully requested in light of the amendments above and the comments which follow.

As correctly noted in the Office Action Summary, claims 1-20 were pending. By the present response, claims 4, 6-15 and 18 have been amended and claims 1-3 canceled. Thus, upon entry of the present response, claims 4-20 remain pending and await further consideration on the merits.

Support for the foregoing amendments can be found, for example, in at least the following locations in the original disclosure: the original claims

OBJECTION TO SPECIFICATION

The specification has been objected to for the reasons set forth in paragraph 1 of the Official Action. Paragraphs [0019] and [0022] have been amended to clarify that the units for distance of the optical stop to the lens are inches and to correct a typographical error in the reference numeral for the detector, respectively. Withdrawal of the rejection is respectfully requested.

CLAIM OBJECTIONS

Applicants acknowledge the renumbering of claims 13-21 as claims 12-20. The listing of claims accompanying this response reflects the change.

CLAIM REJECTIONS UNDER 35 U.S.C. §112

Claims 5 and 8 have been rejected under 35 U.S.C. § 112, second paragraph, on the grounds set forth in paragraph 4 of the Official Action. This rejection is respectfully traversed. It is respectfully asserted that one of ordinary skill in the art would have understood the meaning of each and every term in claims 5 and 8 and that these claims are clear as originally presented. Those skilled in the art of Infrared (IR) detection would have readily recognized the terms "red MWIR," "blue MWIR," and "indigo MWIR" as established terms of art, which reference particular regions of the IR band. Specifically, red MWIR is at a longer wavelength then blue MWIR, e.g., red MWIR is nominally located at or around 4.6 microns and blue MWIR is nominally located at or around 4 microns. The red and blue MWIR refer to two regions in the midwave where the atmosphere transmits MWIR very well. Those skilled in the art recognize these two pass bands as being separated by the CO_2 absorption band. Indigo LWIR is contained within the nominal pass band of or around 7.5 to 12 microns.

Based on the above, Applicants respectfully assert that original claims 5 and 8 are clear. Withdrawal of the rejection is respectfully requested.

CLAIM REJECTIONS UNDER 35 U.S.C. §103

Claims 1-4, 9-13, and 15-20 stand rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 4,507,551 to Howard et al. (hereafter "*Howard et al.*") in view of Applicant's Admitted Prior Art U.S. Patent No. 5,369,511 to Amos (hereafter "*Amos*") and U.S. Patent Publication No. 2001/0029816 to Ben-

Menachem et al. (hereafter "*Ben-Menachem et al.*") on the grounds set forth in paragraph 7 of the Official Action.

As discussed below, the rejection has not established a *prima facie* case of obviousness with respect to Applicants' claims because the proposed combination of references does not teach or suggest all of the claimed features (See MPEP § 2143). Accordingly, these rejections should be withdrawn.

The present application relates generally to infrared imaging systems. Exemplary embodiments of the disclosed infrared imaging system are illustrated in Figures 1 and 2. The infrared imaging system 100 has a compressor housing 102 and an optical housing 104. The optical housing 104 has a cryogenic subassembly 106, an optical subassembly 108 and an electronics subassembly 110. The optical subassembly 108 is positioned within the cold space 116 of the cryogenic subassembly 106 at the receiving end 118 of the optical housing 104. As shown in Figure 2, a detector 208 is positioned in alignment with the other components of the optical subassembly 200 about the axis X-X' at a focal length distance d from the second surface 216 of the lens 206, at a coincident focal plane to at least two wavelengths manipulated and transmitted by the lens 206 and the HOE 222. The detector 208 can discriminate at least two or more wavelengths of incident energy in the IR spectrum, such as wavelengths at 3-12 μm. The detector 208 processes the wavelengths to produce multiple waveband detection capability within a single detector. In an exemplary embodiment, the detector 208 concurrently collects radiation from multiple, adjacent spectral radiation bands. This type of detector may be used in "hyperspectral imaging."

Several advantages of the exemplary infrared imaging system 100 are disclosed at paragraphs [0035] to [0037]. For example, use of a single, color corrected element in the dewar provides an optical subassembly that is shorter and provides for a better form factor and lower part count for the entire infrared imaging system. Also, by enclosing the single lens within the detector dewar, the optical subassembly, including the optical stop, lens and detector, are all located within a single enclosure. Previously, tight alignment tolerances had to be maintained across the detector-to-dewar mount, the dewar-to-optical housing mount and the optical housing-to-optics mount. By eliminating the multiple interfaces the total tolerance budget can be applied on the single interface, reducing the required manufacturing and assembly tolerances and reducing the requirement for precision alignment across multiple interfaces.

In another example, placing the single, color corrected lens 206 in the cryogenic subassembly 106 is advantageous because it places the optical subassembly 200 in a controlled temperature environment. By maintaining the lens 206 at a nearly constant temperature, the need for a passive or active athermalization system to correct the thermally induced focus variations may be eliminated. While this could be accomplished previously by heating or cooling the optics with a separate device, this approach makes use of the cooling capabilities that are already present in the system. Also, enclosing the optical subassembly 200 in the cryogenic subassembly 106 places the optics in a sealed, evacuated environment, protecting it against dust or other contamination. While this could be accomplished in a separate enclosure, this approach makes use of capabilities already present in the optical housing 104.

In addition, the alignment of the optical components permits a detector to be located at the focal plane for the lens system. In previous multi-lens imaging systems, it was difficult to ensure alignment of the optical components because the thermal coefficient of expansion resulted in disparate movement of the individual optical components. A unitary structure housed within the cold space essentially eliminates thermal transients amongst the components once a temperature equilibrium has been achieved by the cryogenic housing and compressor, thereby overcoming the alignment problems.

The foregoing features also permit the design of a lower cost system with the same performance capabilities of current, more expensive ones.

The above features are broadly encompassed by Applicants' claims. Independent claim 4 recites that an infrared imaging apparatus, comprises, *inter alia*, a dewar, having an internal volume that defines a cold space, an IR transmissive window that seals the cold space to receive IR energy directly from an IR source, a first lens located within the cold space to receive IR energy directly from the IR transmissive window, an IR detector located within the cold space in operational communication with the first lens and positioned coincident to the focal plane of at least a first and second wavelength of IR energy, and an optical stop located within the cold space in front of the single lens. The single lens has a first aspheric profile on a first side and a second aspheric profile on a second side, the first side parallel to the second side and the second side facing the detector. The second aspheric profile has a holographic optical element that color corrects at least two color bands of infrared energy.

Applicants' claims broadly encompass the above noted features and are based upon an optical imaging system that brings light from different, infrared spectral bands into a coplanar, aligned image. Claim 4 recites that the holographic optical element color corrects at least two color bands of infrared energy. The different spectral bands collected and imaged by the system disclosed in *Howard et al.* are sufficiently separated so as to require chromatic aberration correction beyond that of prior art. Therefore, it is not inherent in *Howard et al.* that two color bands of infrared energy are color corrected. Accordingly, the claimed feature of a holographic optical element color corrects at least two color bands of infrared energy is not disclosed or suggested by *Howard et al.*

The other documents relied upon by the Examiner, even when considered in combination with *Howard et al.*, fail to disclose, teach or suggest a holographic optical element on an aspheric surface that color corrects at least two color bands of infrared energy. For example, *Amos* discloses forming holographic images. However, *Amos* does not apply his holographic technique to aspheric services nor does he use his holographic technique to color correct at least two color bands of infrared energy. *Ben-Menachem et al.* discloses aspheric surfaces with or without diffractive patterns for correcting aberrations in the optical system. However, *Ben-Menachem et al.* does not disclose, teach or suggest color correct at least two color bands of infrared energy. Thus, the use of a HOE at multiple design wavelengths is not disclosed, taught or suggested in the documents cited by the Examiner, whether considered individually or in the combination suggested by the Examiner.

The remaining claims depend either directly or indirectly from independent claim 4 and are therefore distinguishable over the cited documents for at least the same reason as discussed with respect to claim 4.

Claims 6, 7, and 14 stand rejected under 35 U.S.C. §103(a) as being unpatentable over *Howard et al.* in view of *Amos* and *Ben-Menachem et al.* as applied to claim 1 above, and further in view of U.S. Patent No. 6,034,407 to Tennant et al. (hereafter "*Tennant et al.*") on the grounds set forth in paragraph 8 of the Official Action.

These claims depend either directly or indirectly from claim 4. Because *Tennant et al.* fails to overcome the deficiencies of the documents discussed above, these claims are distinguishable for at least the same reason as discussed with respect to claim 4.

Tennant et al. does not contribute to the combination of documents to render Applicants' claims obvious. *Tennant et al.* simply discloses materials that can be used in multispectral imaging and does not disclose, teach or suggest an infrared imaging apparatus having the combination of features present in Applicants' claims. Withdrawal of the rejection is respectfully requested.

CONCLUSION

From the foregoing, further and favorable action in the form of a Notice of Allowance is earnestly solicited. Should the Examiner feel that any issues remain, it

is requested that the undersigned be contacted so that any such issues may be adequately addressed and prosecution of the instant application expedited.

Respectfully submitted,

BURNS, DOANE, SWECKER & MATHIS, L.L.P.

Date: February 9, 2004

By: Patrick C. Keane

Patrick C. Keane
Registration No. 32,858

P.O. Box 1404
Alexandria, Virginia 22313-1404
(703) 836-6620